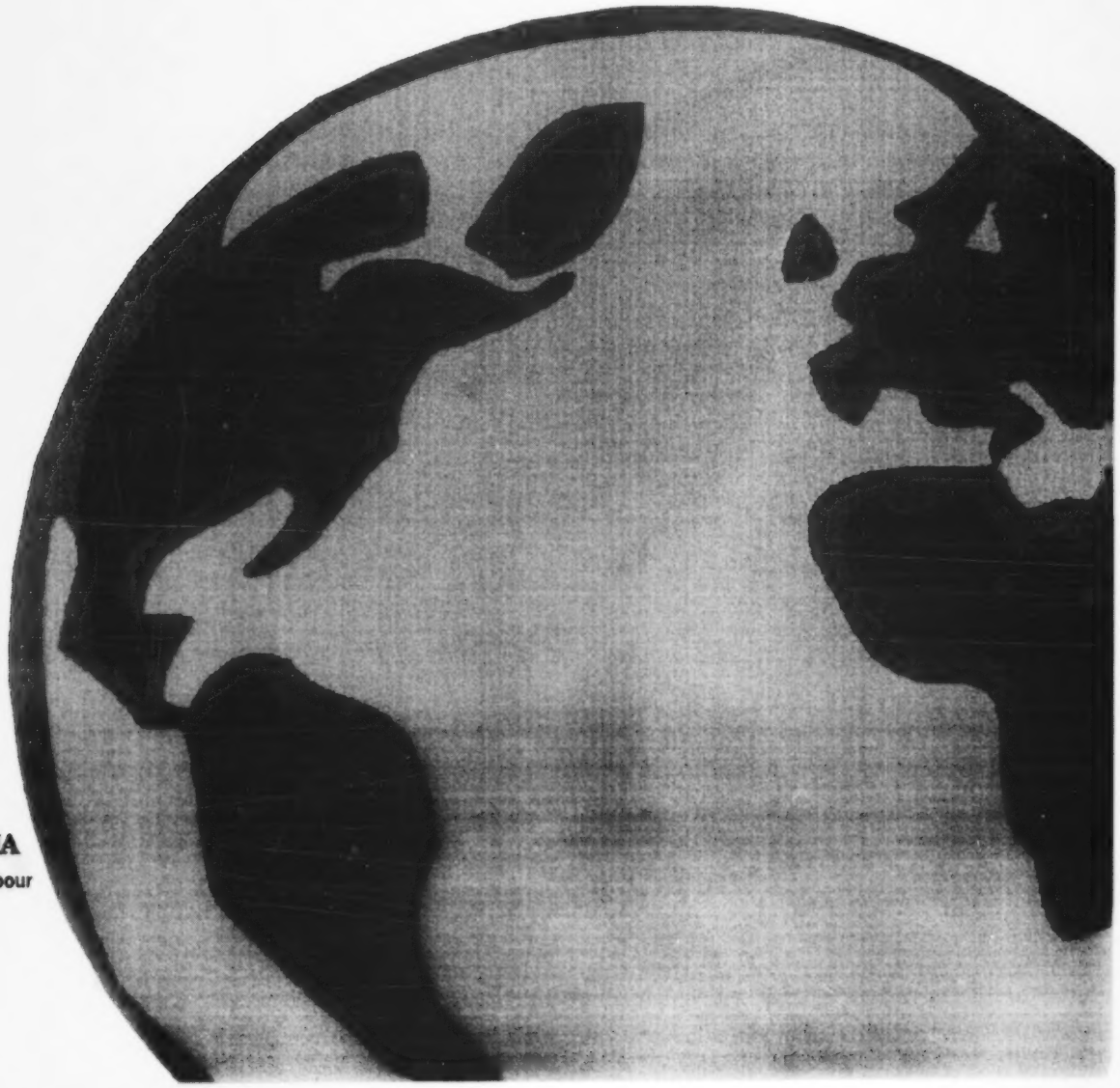
Reducin' Pollution

An Environmental Health and Safety Guide for the Fibreglass Industry

Volume 1: Guidebook



NOVA SCOTIA
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i. Purpose of the Guide

The purpose of this guide set is to provide an up to date reference of some of the 'Best Practices ' used in the fibreglass industry today. The focus of this guide is health and the environment, but most initiatives listed will positively impact quality and productivity as well.

ii. The *Reducin' Pollution* Workbook

A workbook has been produced as a companion piece to this guidebook. The workbook is a tool that can help fibreglass businesses quickly identify how they can improve their environmental performance and develop an action plan.

iii. Acknowledgments

The Canadian Plastics Industry Association and the Nova Scotia Department of Environment and Labour would like to acknowledge the Nova Scotia Composites Environmental Health and Safety Working Group for their assistance in preparing this guide. In particular, they would like to thank Sandy Marshall, Sean O'Brien and Tony Sampson for their time and effort.

iv. Disclaimer:

The authors and sponsors of this guide intend for it to help improve the health and sustainability of the fibreglass industry. Every effort has been made to ensure the information is accurate and up to date. The authors and sponsors do not accept responsibility for accidents, incidents or other problems resulting from anyone following the practices recommended in this guide.

This manual provides information on the benefits of pollution prevention for the fibreglass industry in Nova Scotia. It also provides information on some of the relevant laws in effect in Nova Scotia. It does not provide information on how to comply with all provisions of those laws that may apply to businesses. This manual is not intended to replace reading the legislation and regulations or seeking advice from a lawyer or an environmental expert. Examples and interpretations given are not binding on the Crown. Amendments may be made to the legislation or regulations after the publication of this document and reference should be made to the most recent official version of the legislation and regulations.

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1 The Pressures for Change on the Fibreglass Shop

Today's fibreglass shops face many challenges that will require change. Profitability, technical advances, health and safety, environmental performance and regulatory compliance are but a few of the concerns facing companies today. Planning ahead for change will be essential to the health of the industry.

The FRP industry is a source of hazardous volatile emissions to the environment. In particular, styrene and acetone are the largest contributors. Because of this, the materials used in the FRP open moulding process are under constant scrutiny by health and safety and environmental agencies. Industry standards, legal liability, government regulations, and cradle to grave responsibility are just a few of the phrases we will be hearing on a regular basis.

It is important that both the employees and the employers understand the environmental and Occupational Health and Safety issues facing fibreglass shops. The key issues facing shops daily are summarized in the paragraphs that follow.

Volatile Organic Compounds

Volatile Organic Compounds, commonly referred to as VOCs, are chemical vapours emitted by fresh resin surfaces and by solvents such as acetone. Exposure to VOCs can cause irritation of the eyes, nose and throat, skin problems, nausea and dizziness. Higher concentrations of VOCs can cause irritation of the lungs, wheezing and, in extreme cases, threaten life and health. VOCs also contribute to the creation of smog. They combine with nitrogen oxides (NOx) to create ground-level ozone, the main component of smog.

Styrene and acetone vapours are key VOCs found in fibreglass shops and are a major concern for the fibreglass industry.

Odour Emissions

Controlling the odours associated with fibreglass production are necessary to avoid disturbing those living or working nearby. Odours leaving the plant can be a source of complaint from a shop's neighbours and can negatively affect a company's image in the community as a responsible corporate citizen. Odour emissions related to styrene can be challenging to control, as they are detectable in concentrations as low as 0.1 ppm.

Drum Disposal and Recycling

Empty drums usually retain small amounts of the chemical liquid that they originally contained. These liquids can be toxic or hazardous and should be returned for proper disposal or for recycling. Improperly disposed drums can harm the environment and impact on the health of people and wildlife.

Water Quality Management

Responsible FRP shops should ensure that their operation does not pollute local groundwater or nearby water bodies such as lakes, rivers or the ocean. Water pollution can occur when contaminants are washed away by rainwater or discarded down the drain.

Coping with Styrene

Styrene concentrations in the air are typically measured in parts per million, or ppm. The health impacts of being exposed to styrene become more severe as the concentration of styrene in the air increases. For instance, exposure to a concentration of 200 ppm of styrene can irritate the eyes and nose, and exposure to levels of 350 ppm can lead to short-term neurological impairment, such as dizziness and forgetfulness.

Waste Management

Every business generates some kind of waste. In the fibreglass industry, much of that waste must be specially handled to protect the environment and our health.

In Nova Scotia, the disposal of waste is regulated under the following regulations:

- Solid Waste-Resource Management Regulations (the disposal and recovery of municipal solid waste and construction and demolition waste),
- Used Oil Regulations (the disposal and recovery of used oil), and
- Dangerous Goods Management Regulations (the disposal of waste dangerous goods).

The steps to managing your waste properly can be taken long before the waste itself is generated. The most cost-effective way to manage your waste is to not generate it in the first place. This can be achieved by modifying purchasing practices, using different materials, or using the same materials more efficiently. Once waste is generated, it can be sorted for reuse, recycling or safe disposal.

Hazardous Materials

Hazardous materials (also referred to as dangerous goods) are extremely dangerous in uncontrolled situations and cause serious injury or adverse environmental affects. The storing, labeling and handling of hazardous wastes is regulated by the province through the Dangerous Goods Management Regulations and the Occupational Health and Safety Regulations.

Some typical hazardous materials in use in fibreglass shops include:

- **Resins;**
- Organic peroxides (i.e. hardeners);
- Solvents (e.g., acetone);
- Paints (some paints may have hazardous components); and,
- Contaminated rags and gloves.

About Organic Peroxides...

Organic peroxides can react explosively with flammable materials such as acetone and many other solvents. Prevent fires and explosions by storing organic peroxides away from these types of materials.

Dust Management

The fibreglass dust resulting from grinding cured laminates is a nuisance and a physical hazard for workers. It is also a workplace combustible and can be a fire hazard. Allowable limits for dust concentrations are set by the Occupational Health regulations. Dust escaping from the shop can also be a nuisance for those living nearby.

Noise Management

Noise is an unavoidable occurrence in many industrial processes, but it should be prevented from becoming a nuisance. Sources of noise pollution from a fibreglass shop may include outdoor bells, whistles or public address systems, trucks and heavy vehicles, mechanical ventilation systems, noisy machinery such as compressors or pumps, and loud or obnoxious behaviour.

2 *Pollution Prevention and You*

The idea behind pollution prevention is surprisingly simple - prevent pollution by not creating it in the first place.

We can find reasons for pollution prevention all around us. Some we see everyday, such as children, family, and friends. Pollution prevention helps to protect the air they breathe, the water they drink, and the ground upon which they walk. It works to protect their health and safety from the hazards of a polluted and damaged environment.

Pollution prevention also protects the things we take for granted. Things like the waters where we fish, the rivers where we sail, and the lakes in which we swim. Things like the woods we camp in, the fields we toil on, and our own backyards.

Adopting pollution prevention does not necessarily mean large high-tech changes, but instead involves rethinking how we do things. Simple changes in behaviour and workplace practices can prevent pollution and not be costly. Pollution prevention can even save your company money. Some of the benefits of pollution prevention to the workplace include:

- The reduced costs of using fewer raw materials
- Improvements to worker health and safety and environmental performance
- Lower costs on ventilation and safety equipment
- Easier compliance with regulations and reduced paperwork burden
- Reduced waste transportation and disposal costs
- Reduced long-term liability and insurance costs

Pollution prevention protects the environment by improving the way we do business. It focuses on areas such as:

- The use of hazardous and dangerous materials
- Using natural resources efficiently
- Conserving natural resources
- Improving production processes to create less waste
- Training
- Modifying or improving equipment
- Using more environmentally-friendly materials
- The design or formulas of products
- Product life-cycles
- Purchasing practices

3 Pollution Prevention Best Practices for the Fibreglass Shop

This section outlines some of the best practices in use for Pollution Prevention. Regulatory issues are also noted to point out compliance issues. New ideas and regulations are being generated on a continuous basis so this list should not be considered complete. These are just some of the options that are available. Businesses are encouraged to demonstrate their leadership and innovation by incorporating other pollution prevention methods into their own business operation.

To help you identify the practices that most interest you, several of them are identified using any of the three icons below.

This icon tells you when a best practice can save you money.

This icon indicates that a practice can help you lower your shop's levels of volatile vapours such as styrene, acetone or other VOCs.

Practices that deal with regulations and the law are indicated with this icon.

The *Reducin' Pollution* Workbook

The *Reducin' Pollution* guidebook comes with an easy-to-use workbook that can help you turn your fibreglass company into a pollution prevention leader. Use the workbook to identify how your company can improve its pollution prevention practices and then to develop a pollution prevention action plan!

3.1 Designing your Product

Designing your products with the efficient use of materials in mind can save money and minimize pollution *before* you start building!

- **Optimize the design of your product**

  Design your products to use fewer materials while maintaining quality and function. Comply with applicable production codes and standards.

- **Use core materials to strengthen your design while using less glass and resin**

  Materials such as balsa wood, foam or honeycombs can be used as cores to build stronger and more rigid pieces using less resin and glass. This reduces your use of hazardous materials and lowers your emissions.

- **Use engineered reinforcements to increase the strength of your product**

  Knitted fabrics and other advanced materials can be used to increase the strength and hardiness of your product while minimizing the use of resin and glass.

- **Use non-hazardous fillers when building large pieces**

  Fillers can help you obtain the size you need while reducing your use of resin.

- **Substitute hazardous products with less hazardous ones where possible**

  Less-hazardous substitutes can help you reduce emissions and make your workplace safer. Check with your local product supplier for alternatives that work.

- **Specify low styrene resins and gelcoats**

  List low-styrene resins and gel coats in product design specifications.

- **Incorporate flanges into your mould design**

  Mould flanges reduce overspray, which result in fewer emissions and reduced waste.

- **Educate your customers on "Environmentally Friendly" alternatives**

  Demonstrate corporate leadership and generate a demand for your environmentally friendly product designs by promoting their environmental benefits.

- **Consider the end-of-life recyclability of your finished product when designing it**

  Reduce the environmental burden of your products by designing them to be easily recycled or reused.

3.2 *Purchasing your Raw Materials*

The type and amount of materials purchased directly impacts on the degree of environmental risk and the ease of complying with regulations. Use your purchasing practices to reduce pollution, minimize your waste, and save your company money.

- **Purchase smaller quantities to limit storage and age expiry issues**

  Buy only what you need instead of stockpiling. Smaller quantities make it easier to comply with the Dangerous Goods Management Regulations and can reduce the waste of expired materials.

- **Assess the true cost of your raw materials**

  Materials such as resin, catalysts, solvents, release agents, etc have hidden costs above their purchase price. Incorporate the costs of storage, handling, disposal, occupational health and safety and other issues when assessing the cost of your supplies.

- **Track production to allow for smaller inventories**

  Improve your production system to monitor how much material is used and how much is left. This will let you store smaller quantities on-site while maintaining the supply required for production. Storing smaller quantities of hazardous materials makes it easier to comply with provincial regulations.

- **Purchase products in recyclable containers that use a minimum amount of packaging**

  Recyclable containers and less packaging means less waste. Use suppliers that take back their drums and waste packaging for reuse or recycling.

- **Encourage suppliers to demonstrate new products and ideas**

  A good supplier can introduce you to new products and methods that can help your company be a leader in pollution prevention.

- **Use local materials and recycled materials where possible**

  Using local materials generates fewer emissions from shipping and helps your local economy. Use recycled materials in your shop to help protect the environment by conserving natural resources and energy.

3.3 Storing your Materials

Properly storing dangerous goods such as resin, catalysts, solvents, release agents and other products is crucial for all fibreglass shops. Improperly stored dangerous materials are fire hazards that threaten worker health, the environment and are also against the law! The storage, labeling and handling of dangerous goods is regulated under the Dangerous Goods Management Regulations, the Occupational Health and Safety General Regulations, and the Fire Safety Act.

- **Keep minimum quantities**

  Store only what is needed to avoid stockpiling.

- **Track your inventory closely**

  Generally, use the "first in, first out" rule to limit spoilage, but always check the expiry dates for materials at receiving. The Dangerous Goods Management Regulations require that an inventory be kept of all dangerous goods and waste dangerous goods in storage.

- **Train your workers on WHMIS, regulations, and emergency procedures**

  The WHMIS regulations require employees to receive WHMIS training when regulated materials are used or stored in a workplace. Dangerous materials must be labelled and the Material Safety Data Sheets must be available. The Dangerous Goods Management Regulations require that general storage facilities are staffed with employees who are trained to respond to emergencies related to dangerous goods or waste dangerous goods stored at the facility.

- **Report the spill, leak or release of any dangerous or hazardous materials**

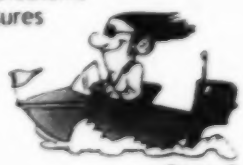
  Under the Emergency Spill Regulations, all spills, leaks and releases of dangerous goods or waste dangerous goods must be reported to the Nova Scotia Department of Environment and Labour if the volume spilled exceeds what is specified in the legislation or if there is a danger of adverse effects. If your shop is responsible for a spill, then it is required to stop the leak and repair the damage done to the environment.

- **Store all flammable and reactive materials safely and according to regulations**

  Organic peroxides (for example, catalysts or "hardeners") are highly reactive and must be stored separately from flammable and organics materials.

- **Keep a safe and clean storage area**

  Clean and tidy your storage area regularly, and follow these storage safety tips:
  - Prevent spills and leaks
  - Avoid hazards from loading and unloading
  - Put measures in place to prevent spills and leaks from entering the environment
  - Ensure that containers used for storage are designed, constructed and maintained adequately to avoid leaks and spills
  - Make sure all storage buildings, rooms and areas housing dangerous materials are clearly labeled (using signs as prescribed by the Federal Transportation of Dangerous Goods Regulations)
  - Build and maintain your storage facility so that weather (for example, rain, snow, heat, frost, wind and humidity) has no impact on how it safely stores hazardous materials
  - Equip your storage area with the equipment and materials needed in case of emergency
  - Store your materials so they can be easily inspected for leaks and other problems
  - Ensure your storage facility includes fire prevention and protection measures (for example, sprinklers)
  - Have an emergency response plan
  - Keep your storage area secure from the public



3.4 Pouring and Mixing your Materials

Bad pouring and mixing practices do more than emit styrene and release VOCs to the air. They can also cause adverse environmental impacts, contaminate property, and pollute watercourses and groundwater. Sloppy pouring and mixing also wastes product and can create dangerous, explosive situations.

- **Order your materials pre-mixed, and always agitate the drums before using**

  Pre-mixed materials avoid the emissions given off during mixing and reduce the amount of material that is lost by evaporation. Agitate, shake or stir the drums before using to prevent settling and to make sure the materials are well mixed.

- **Improve your tracking system to account for substance use and waste generation**

  A good tracking system monitors your supply of materials and reduces wasteful practices.

- **Modify your production schedule to improve the efficiency of your process**

  An efficient process uses less time, less product, and less money.

- **Label your products and wastes as specified by the WHMIS regulations**

  Not only does labeling dangerous goods and wastes protect workers and property, it's also the law! The storage and labeling of dangerous goods is regulated under the WHIMS regulations and the Dangerous Goods Management regulations.

- **Follow the proper procedures for mixing and transferring product and cleaning tools**

  Many materials must be mixed in a particular order to ensure that the ingredients are completely dispersed. Materials added out of order can interfere with the mixing of others and reduce the quality of the product.

  Put procedures in place to ensure that materials are transferred safely and without waste. Materials transferred carelessly can spill, evaporate, or explode. Use dispensers and drip trays to reduce and catch spills.

  Follow the manufacturer's instructions when cleaning equipment to prevent damage to the gear and the waste of cleaning supplies.

- **Use a proper electrical system, inspect it regularly and eliminate sources of static charges**

  When dealing with volatile liquids, sparks can generate fires or explosions. Use explosion-proof motors and lights in any areas where you are pouring or mixing materials to avoid igniting volatile liquids and vapours. When pouring liquids, bond or ground your drums and containers together to prevent static discharges.

- **Practice good housekeeping**

  Stopping leaks, avoiding spills and covering all containers will not only keep your shop looking good, it will make it a safer place to work, reduce emissions, and prevent waste. It will also prevent environmental damage and avoid expensive clean-ups.

Use Peroxides Safely

Never mix peroxides directly with promoters or accelerators. Doing so may cause a fire or an explosion.

3.5 Producing your Fibreglass Product

A major source of the hazardous volatile emissions emitted by fibreglass shops occurs during production and the product lay-up or spray-up. There are several ways in which a fibreglass shop can modify its practices to reduce these emissions. This section examines how to improve production methods, systems and equipment.

Production Methods

- **Where appropriate, invest in a closed-mould system instead of open-mould (e.g. infusion, vacuum or resin transfer processes)**

  Styrene emissions are high in open-mould systems because of the techniques used to apply the resin and the curing of parts with large surface areas. A closed-mould system can prevent vapours and odours from escaping during the application or the curing of resin.

- **Use styrene suppressants in the resin to limit emissions**

  Vapour suppressing agents such as paraffin waxes (e.g. "air dry") can be added to resins to reduce emissions. Ask your supplier which suppressant is right for your process.

- **Apply a thicker lay-up or spray-up at one time**

  A thicker lay-up or spray-up lowers emissions by reducing the amount of curing resin exposed to the air. This may require changing the amount or the type of resin and/or catalyst used.

- **Manage your cure system through good catalyst practices, and trial alternative cures**

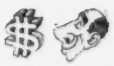
  Different catalysts and cures are available that can help you reduce styrene emissions by shortening cure time. Get expert advice from your supplier on new and innovative products that can help you meet your pollution prevention goals.

Production Systems

- **Improve the production schedule to maximize process efficiency**

  An efficient production process will reduce non-productive work, save money, use less material, and produce less waste.

- **Use the best equipment and materials suited for the job and use only what you need**

  It is easy for workers to apply too much resin. Train employees on the proper wet-out techniques and on monitoring glass-to-resin ratios.

- **Track the use of materials, waste generation and costs**

  Monitoring how and when your inventory is used can help you reduce how much of it is wasted through spoiling and can keep you from purchasing more than you need.

- **Improve housekeeping and maintenance**

  Good housekeeping can boost product quality, production efficiency, employee moral and workplace safety.

- **Improve worker training and awareness**

  Train staff in techniques that minimize waste and generate fewer emissions. Awareness programs can promote a workplace culture that values environmental protection practices.

Production Equipment

- **Use non-atomized resin applicators such as fluid impingement, flow coaters or pressure-fed roller impregnators to apply resins and gelcoats**

  Non-atomized applicators minimize the amount of resin particles sprayed into the air, lowering styrene emissions.

- **Use a mill gauge when applying gelcoats to measure the thickness of the application**

  This will ensure that the optimum amount of gelcoat is used - not too much, not too little.

- **Install overspray flanges on all moulds to reduce the area of overspray**

  Reducing overspray limits waste and reduces emissions.

- **Use in-line resin heaters instead of extra styrene to improve the flow of resin**

  When resin cools, it becomes thick and difficult to pump through the applicator lines. This can affect the quality of the spray and the finished product. In-line heaters raise the temperature of the resin as it goes through the line to the applicator gun.

  Band heaters, which wrap around resin drums like belts, should be avoided if possible. They heat drums inefficiently, may use sparking thermostats, and can be a fire hazard. Any band heaters that are used should be approved for use in a flammable or hazardous area.

Did you know?

Controlled spraying can reduce gel coating emissions by up to 40% and laminating resin emissions by up to 20%!

3.6 *Training and Awareness in the Workplace*

When encouraging workplace employees to adopt new and safer practices, training and awareness is key. There are many new and safer production techniques that workers can use if they are shown how.

- **Show spray operators how to use controlled-spraying techniques**

  Controlled spraying reduces styrene emissions by improving transfer efficiency.

- **Train operators to apply only specified amounts**

  Operators can easily use too much resin during lay-up or spray-up. Provide your staff with the skills they need to judge how much resin is needed.

- **Make it a routine practice to follow the proper procedures for mixing, transferring and applying gel coats and laminates and for cleaning and maintaining equipment and moulds**

  Design safe work practices and ensure that these practices are understood and followed.

- **Provide employee training on regulations, emergency procedures, and on health and safety issues.**

  Businesses using hazardous materials and dangerous goods are responsible under the WHMIS regulations to provide employee training on the safe handling of these materials and on the Material Safety Data Sheets (MSDS) used to label them.

- **Train staff on proper housekeeping practices**

  Train employees to adopt the housekeeping practices that will keep your shop clean and safe. These practices include keeping lids on containers, controlling waste, and using curbs and other methods to prevent spills.

- **Train employees on how to use emergency equipment - and keep the equipment in a convenient, visible location**

  The use and availability of protection equipment in the workplace is regulated under the Occupational Health and Safety Regulations. Examples of equipment typically required FRP shops include personal protection equipment (PPE) such as respirators and gloves, first aid supplies, eyewash bottles, and spill clean-up equipment. Keep emergency phone numbers posted nearby in case of emergency.

- **Wear gloves and avoid using acetone to wash hands**

  It is a common but unsafe shop practice to wash resin from hands using acetone. Enforce the use of gloves and provide convenient handwash stations. Use only safe hand cleaners to clean hands.

3.7 *Cleaning your Equipment and Tools*

Not only will these steps improve the quality of the air in your shop, it will also reduce your risk of harming the environment and improve the environmental performance of your company.

- **Switch to a non-VOC type cleaning solution**

  Solutions with a high boiling point evaporate less and release fewer emissions into the air. Ask your supplier for an emulsifying-type product that can meet your needs.

- **Use cleaning solvents for a longer period of time**

  Ensure cleaning solvents are well used and very dirty before properly disposing or recycling them. Solvents disposed or recycled prematurely are not used efficiently and increase costs.

- **Use the "two buckets" washing system - one is clean, and the other is dirty**

  The "two bucket" washing system lets you get the most use out of your cleaning solvents. The "dirty" bucket is used to clean your equipment, while the "clean" bucket rinses them. When the "dirty" bucket can no longer be used, the dirty solvent is properly disposed or recycled, the "clean" bucket becomes the new "dirty" bucket, and fresh solvent is brought in to be the new "clean" bucket.

- **Keep lids on all buckets**

  Prevent solvents from evaporating by keeping their lids on. Solvents will last longer and fewer VOCs will escape into the air.

- **Install a gun cleaning tank or unit**

  Properly cleaning your equipment will prevent glass and resin from jamming spray guns and being wasted. Use a gun wash station or something similar to minimize VOC emissions when cleaning spray equipment.

- **Ration solvents and other material**

  Control how much solvent is distributed at a time to workers and ensure it is completely used before giving out more.

- **Limit the number of cleaning buckets in the workplace**

  Fewer cleaning buckets will reduce emissions and waste less solvent.

- **Physically remove excess resin from tools before using a solvent wash**

  This will reduce the amount of solvent that is required to clean your equipment.

- **Collect all used solvent and recycle it "in-house" or by using contractors**

  Recycling used solvent saves energy, reduces emissions and helps to protect the environment. Used solvents are considered waste dangerous goods and must be collected and disposed of by an approved hazardous waste facility. Solvents and waste cleaning solutions are not to be dumped or thrown away in a manner that may cause an environmental impact, and they are not to be poured down the drain.

  The disposal and handling of dangerous solvents and waste solvents are regulated under the Dangerous Goods Management Regulations.

3.8 *Managing your Waste*

Responsible waste management is not just a sound environmental and economic practice, but it is also legislated in Nova Scotia. Reducing your waste and managing it properly can result in lower tipping fees, reduced transportation costs, and cost savings through the reuse and recycling of materials.

- **Keep your workplace tidy and well maintained.**

  A tidy workplace is safer, more organized and less likely to waste materials.

- **Identify wastes with clear and easy-to-read labels**

  Labeling waste product will make your shop a safer place for your employees and is required under the Occupational Health and Safety Act, the WHMIS Regulations and the Dangerous Goods Management Regulations.

- **Keep lids on all wastes**

  Lids must be kept on containers of waste to contain them and to prevent them from filling up with water. The storage of waste dangerous goods is regulated under the Dangerous Goods Management Regulations.

- **Use all of the product from the drums**

  Turn the drums upside-down for one or two hours to ensure all of the material is drained out of the drums and into a tray or a bucket.

- **Store empty drums properly**

  Once the drums are empty, screw the bungs back in and place the drums on their side to prevent water damage and rust. Keep them clean and have them picked-up for recycling.

- **Minimize the amount of grinding, cutting and sanding that you have to do.**

  This saves time, reduces the amount of airborne dust and small particles, and reduces waste.

- **Collect dust at the source using well-placed vents and vacuums**

  This will release less dust into the workplace and make its collection easier.

- **Develop a waste management system that allows your workplace to separate, reuse and recycle waste**

  An effective waste management system will reduce the amount of waste generated by your shop and can help you find innovative ways to reuse scraps and other wastes.

- **Dispose of hazardous waste and solid waste properly**

  Waste dangerous goods or hazardous waste (for example, resins, hardeners, solvents, paints, and contaminated items such as rags, gloves, and clean-up materials) must be collected and disposed of by an approved hazardous waste collector and/or a facility. The Regional Offices of the Nova Scotia Environment and Labour can provide a list of facilities approved to take hazardous waste. Contact your local municipal office for information on local solid waste disposal regulations.

- **Do not open-burn wastes (e.g. barrel burning)**

  The burning of waste, dangerous goods, plastic or materials containing plastic generates significant amounts of air pollution and is strictly prohibited by the Solid Waste-Resource Management Regulations and Air Quality Regulations.

3.9 Designing your Facility

Pollution prevention should be incorporated into the design of any production facility. A wide range of considerations should be included, such as energy efficiency, waste management, noise pollution, and others.

- **Design and maintain your facility to be energy efficient in order to reduce heating and electrical costs**

  There are numerous ways in which a company can become more energy efficient, by changing the types of light bulbs used, improving insulation, and turning off the lights when a room is empty. Design your structure so parts of it can be shut down when not in use. Improving energy efficiency saves money through heating and electricity costs and reduces the emissions of greenhouse gases and smog-producing pollutants.

- **Limit the size of your lay-up area to reduce ventilation and heating requirements**

  Determine how much space is needed to do the work required. A smaller lay-up area means less space to ventilate and heat. An efficient design will fit the maximum number of stations in an area and eliminate wasted space.

- **Use proper temperature controls in the production areas to improve process efficiency**

  The working qualities and cure rates of fiberglass resin are affected by room temperature. Include temperature controls to keep resin at its optimum temperature to improve productivity and reduce curing time.

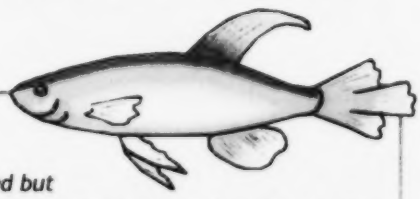
- **Plan your ventilation system to reduce the overall air-flow while controlling dust and chemical hazards**

  A ventilation system with adjustable controls can meet the specific ventilation demands of different conditions. Consider the direction of the airflow, variable speed fans, dampers, and automatic switches in your design. Avoiding unnecessary ventilation reduces energy use and decreases the demands on your ventilation equipment.

  Ventilation in the workplace is regulated under the Occupational Health and Safety General Regulations.

- **Design for emergencies, fire protection and spill containment**

  There are numerous regulations dealing with safety to consider when designing your facility. The Occupational Health and Safety General Regulations and the Dangerous Goods Management Regulations regulate how dangerous goods and wastes are stored. The Petroleum Management Regulations legislate the handling, use and storage of gasoline, furnace oil, diesel fuel and waste oil. The Fire Safety Act covers fire safety in buildings and the safe storage of flammable and combustible materials.



Did you know?

The water carried away in storm drains generally is not treated but instead is dumped directly into lakes, rivers or other drainage areas. Contaminated water entering the storm drain can carry pollutants into aquatic habitats, harming fish and other wildlife.

4 Environmental Health and Safety Management Systems

An Environmental Health and Safety Management System (EHSMS) is a tool used to improve an organization's environmental performance and to ensure compliance with environmental and occupational health and safety (OH&S) regulations.

An EHSMS will address the relevant environmental and OH&S issues associated with the processes of a fibreglass shop. It will identify the risks and provide a systematic method for controlling them. The complexity and detail of the system varies with the degree of risk. Low risk activities can be maintained with checklists, control measures and proper record keeping. High-risk activities require an EHSMS with greater detail.

The structure of your EHSMS will vary depending on the size and complexity of your organization. For example, an EHSMS could be designed to meet ISO 14000 standards or the CPIA Industry Standard. Simply put, an EHSMS is a framework to help you:

1. Define your Operations;
2. Define your Costs; and
3. Define your Obligations.

The goal of an EHSMS is to improve business performance, reduce environmental impact and protect employee health and safety through good management practices. An EHSMS would include components on:

- Monitoring and reporting;
- Record keeping;
- Training employees;
- Responding to complaints; and
- Responding to emergencies and incidents.

Start your EHSMS by defining the current state of your business and the true costs of operation. This guide and accompanying workbook lists many of the compliance issues that affect the fibreglass industry and will provide ideas for change.

5 Complying with Regulations

Operating a business using regulated or hazardous materials costs money. The costs of using these products and managing the wastes they generate are often underestimated because of their many "hidden" costs. These overlooked costs must be included in your planning, some of which include:

- Safety equipment and personal protection equipment
- Worker training, such as WHMIS
- Emergency planning for things such as spills, fires, etc.
- High insurance premiums and reduced coverage
- Meeting the requirements for receiving areas, storage areas, secondary containment, and sprinklers
- Capital and operating costs for fume and dust control
- Costs associated with inspections, sampling, testing, monitoring and recording
- Solid and hazardous waste removal costs

Some of the key environmental and occupational health and safety regulations that apply to the fibreglass industry are reviewed in the following paragraphs. **It is noted that this guidebook provides only some information on the relevant legislation in affect in NS; it does not provide information on how to comply with the legislation. There may also be additional federal and municipal legislation applicable to fibreglass businesses. It is the responsibility of business operators to know the legislation that pertains to their business and to be aware of any amendments to legislation that may affect their business.**

Environmental Legislation

- *Dangerous Goods Management Regulations*

Fibreglass manufacturers may require an approval to store dangerous goods and waste dangerous goods at the shop depending on the products used and the volumes on site. The storing, labeling and handling of the products are regulated.

Waste dangerous goods may not be dumped or disposed in a way that may cause an adverse environmental affect. These products must be collected and disposed of by an approved hazardous waste collector and/or facility.

Dangerous goods and waste dangerous goods must be handled and stored in a way that prevents spills, leaks and releases into the environment.

Want to learn more?

Additional information can be obtained on the World Wide Web or by calling the Nova Scotia Department of Environment and Labour at 424-5300 or your local office. Website addresses on these regulations and other environmental and OH&S topics can be found on page 21 of this guide.

- *Petroleum Management Regulations*

The handling, use and storage of gasoline, furnace oil, diesel fuel and waste oil is legislated by the Nova Scotia Department of Environment and Labour.

- *Used Oil Regulations*

Waste oil can only be collected and disposed by an approved used oil collector. The burning of used oil is strictly controlled and an approval/registration is required.

- *Air Quality Regulations and the Solid Waste-Resource Management Regulations*

The open burning of waste, plastic or materials containing plastic and dangerous goods is strictly prohibited. Local municipal offices can be contacted for information on authorized disposal sites for solid waste.

- *Emergency Spill Regulations*

Response to the release of dangerous goods or waste dangerous goods is controlled under these regulations. You must report a spill or leak to the Nova Scotia Department of Environment and Labour (NSEL). Reporting is required if volumes exceed those specified in the legislation or if an adverse effect is caused or may be caused. Users of regulated materials must stop the spill or leak and restore the environment to the satisfaction of NSEL.

- *Activities Designation Regulations*

An approval is required if a company constructs or operates a landfill. An approval is required if a company plans to dispose of waste on their property

- *On-Site Sewage disposal Systems Regulations*

On-Site septic systems must have an approval from NSEL.

Occupational Health and Safety Legislation

- *Occupational Health and Safety Act*

The Internal Responsibility System (IRS) is the foundation of the Occupational Health and Safety Act. Under the IRS, all "workplace parties" influence what a workplace is like so they must all share responsibility for making the workplace safer and healthier. The Act sets out the responsibilities and duties of all workplace parties.

Under the Act, employees do have a "voice". The Act provides all workplace parties with the three basic rights. They are:

1. The Right To Know - Employees have the right to information on issues that affect their health and safety.

2. The Right To Refuse - Employees have the right to refuse unsafe or unhealthy work.

3. The Right To Participate - Employees have the right to participate on health and safety committees or be a Health and Safety Representative. Employees also have the right to report unsafe conditions, and voice their concerns or opinions on any issue that affects their health and safety or the health and safety of anyone at the workplace. If an employee believes that they have been discriminated against, or if discrimination has been threatened by the employer, due to health and safety issues, they have the right to make a complaint or file a grievance.

Occupational Health and Safety- General Regulations

The Occupational Health and Safety General Regulations is a large document with a number of sections on employee health and safety. Sections and subsections pertaining to the fibreglass industry are:

- Personal Protective Equipment (PPE), such as:
  - The use of personal protective equipment
  - Hazards to the eyes, face or neck
  - Hazards to the head
  - Hazards to the foot or skin
  - Respiratory hazards

- Ventilation, Lighting, Sanitation and Accommodation, which includes:
  - Ventilation
  - Lighting
  - Drinking water
  - Toilets
  - Hand-cleaning facilities
  - Eating areas
  - Work clothes and change rooms
  - Emergency showers and eyewashes
  - Housekeeping
  - Fire protection and escape

- Handling and Storage of Material, which includes:
  - The storage of Hazardous substances

- *Workplace Hazardous Materials Information System Regulations (WHMIS)*

The WHMIS regulations address the need for employee training, labeling and the significance of the material located on Material Safety Data Sheets (MSDS). These regulations apply when a controlled product is used or stored in a workplace.

- *Occupational Health and Safety First Aid Regulations*

The First Aid Regulations outline the need for first aid training and appropriate first aid kits. The number of employees at the workplace determines the level of training and the type of kit required.

- *Occupational Health Regulations*

The Occupational Health Regulations refer to the American Conference of Governmental Industrial Hygienists Booklet of Threshold Limit Values and Biological Exposure Indices. This document outlines occupational health standards relating to gases, vapours, mists, fumes, smoke, dust and other chemical substances and physical agents.

A common chemical encountered in the fibreglass industry is styrene. The current Threshold Limit Value (TLV) for styrene is 20 ppm Time Weighted Average (TWA) and 40 ppm Short-Term Exposure Limit (STEL).

The TLV-TWA is the time weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be exposed for an extended period of time without adverse effect. The TLV-STEL is the concentration to which it is believed that employees can be exposed without suffering acute health effects. A TLV-STEL is defined as a 15-minute TWA exposure that should not be exceeded at any time during the workday. The STEL should not occur more than four times during a workday and there should be 60 minutes between successive exposures.

6 Resources

6.1 Government Departments

Nova Scotia Environment and Labour

5151 Terminal Road
PO Box 697
Halifax, Nova Scotia
B3J 2T8

Phone: (902) 424-5300
Toll Free: 1-877-9ENVIRO
Fax: (902) 424-0503

Website: http://www.gov.ns.ca/enla/
Pollution Prevention website: go to the NSEL website, click on "Information and Services", and find Pollution Prevention under "P" in the index.

Office of the Fire Marshall

Nova Scotia Environment and Labour
5151 Terminal Road, 6th floor
PO Box 697
Halifax, Nova Scotia
B3J 2T8

Phone: (902) 424-5721
Toll Free: 1-800-559-3473 (FIRE)
Fax: (902) 424-3239

Website:
http://www.gov.ns.ca/enla/ofm/index.htm

For more information on the government regulations described in this guide, please visit the following websites:

Regulations under the Occupational Health and Safety Act (including the general regulations, first aid regulations and the WHMIS regulations)
http://www.gov.ns.ca/enla/ohs/publicat.asp

Dangerous Goods Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envdgm.htm

Petroleum Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envpetma.htm

Used Oil Regulations
http://www.gov.ns.ca/just/regulations/regs/env17996.htm

Air Quality Regulations
http://www.gov.ns.ca/just/regulations/regs/envairqt.htm

Solid Waste-Resource Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envsolid.htm
http://www.gov.ns.ca/enla/emc/wasteman/ (Solid Waste Resource Management branch homepage)

Emergency Spill Regulations
http://www.gov.ns.ca/just/regulations/regs/env5995.htm

6.2 Additional Websites

Environment Canada

Homepage
http://www.ec.gc.ca

Canadian Environment Protection Act
http://www.ec.gc.ca/CEPARegistry/default.cfm

National Pollutant Release Inventory
http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm

Canadian Plastics Industry Association (CPIA)
http://www.cpia.ca/

American Composites Manufacturers Association (ACMA)
formerly the Composites Fabricators Association (CFA)
http://www.acmanet.org/index.cfm

Environment Canada (Atlantic Region) Pollution Prevention website
http://www.ns.ec.gc.ca/epb/pollprev/index.html

Eco-Efficiency Centre
http://www.dal.ca/eco-burnside

Canadian Centre for Pollution Prevention
http://www.c2p2online.com

United States Environmental Protection Agency
http://www.epa.gov/epahome/p2pgram.htm

American Solvents Council
http://www.americansolventscouncil.org

Fiberglass Fabrication Industry: Northwest Pollution Prevention and Regulatory Perspectives
http://www.pprc.org/pprc/sbap/fiber/p2techs.cfm

The American Conference of Governmental Industrial Hygienists (ACGIH)
http://www.acgih.org/home.htm

6.3 Publications

Pollution Solutions: Fibreglass Product & Plastic Foam Manufacturers (April 2000)
Brisbane City, Australia
http://www.brisbane.qld.gov.au/_downloads/permits_environmental_fibrglas.pdf

A Guide for Reducing Worker Exposure to Styrene (November 1996)
Canadian Plastics Industry Association

Introduction to Pollution Prevention (July 1995)
United States Environmental Protection Agency
http://www.epa.gov/opptintr/library/ppicdist.htm

Guides to Pollution Prevention: The Fibreglass Reinforced and Composite Plastics Industry (October 1991)
United States Environmental Protection Agency
http://www.epa.gov/opptintr/library/ppicdist.htm

Journals

Composites Fabrication
Published by the American Composites Manufacturers Association
http://www.cfmagazine.org/

7 Glossary

Acetone: is a solvent commonly used in fibreglass shops for cleaning tools and equipment.

Barrel Burning: is the act of burning waste in a barrel or drum. It generates significant amounts of pollution and is prohibited in Nova Scotia.

Catalysts: are added to epoxy and polyester resins to make them harden. Also referred to as hardeners.

Closed-Mould Systems: are those that completely encase the resin within a mould. The resin then cures while sealed from the open air.

Compaction Roller: is a serrated or bristle roller that comes in various shapes. It is used on most laminates to provide compression and movement of the reinforcement in order to ensure wetout and to remove trapped air.

Controlled-Spraying: is a method of applying fibreglass resin using a spray gun and closed containment mould flanges. It reduces styrene emissions by minimizing the amount of spray gun atomization and by reducing the amount of overspray lost off the mould edge.

Core Materials: are used to stiffen fibreglass laminates. Examples of core materials used are balsa wood, foam, or honeycomb.

Curing: is the chemical reaction that takes place while the catalyzed resin changes from a liquid to a solid. Heat is generated during this process and as much as 50% of the styrene emissions occur.

Dangerous Good: is defined in the Dangerous Goods Management Regulations as a substance that conforms to the criteria set out in the federal Transportation of Dangerous Goods Regulations or is designated as a dangerous good in Schedule B of the federal Transportation of Dangerous Goods Regulations. This generally includes (but is not limited to) products, substances or organisms are included in at least one of the nine following classes: explosives, gases, flammable liquids, flammable solids, oxidizing substances, poisonous or infectious, radioactive, corrosive, or miscellaneous.

End-of-Life: refers to the period when a product is no longer usable or wanted.

Engineered Reinforcements: are synthetic - or man-made - materials that can be used to add rigidity or strength to fibreglass forms. Examples include knitted fabrics, three-dimensional fabrics, carbon fibre, aramid fibres such as Kevlar, and high tension steel wire.

Flow Coater: is a mechanical resin applicator that uses a catalyzing resin pump with a number of low pressure streams to deliver catalyzed resin directly to a laminate. A flow coater can also be outfitted to deliver chopped glass fibres.

Fluid Impingement System: is a delivery system that creates a flat, fan shaped sheet of catalyzed resin by shooting two high pressure streams of resin at each other at a precise angle. The catalyst can be mixed with the resin within the gun (an internal mix) or as it exits the spray tip (an external mix). The system can be used to deliver chopped glass fibres as well.

Groundwater: is the water system that flows under the ground. Groundwater often flows into (and in some cases replenishes) drinking wells, water receivers, lakes, and streams.

Hand Lay-Up: is the process of manually placing the fibreglass reinforcements (such as mats, woven roving, knits, etc.) into the mould or onto part, where resin is then applied mechanically or manually.

Infusion Resin Transfer: is the process of filling an enclosed reinforcement layer with resin. This is usually done by a vacuum drawing the resin into the emptied air spaces. It can also be assisted by applying pressure to the resin to help push it through the fibres.

In-Line Resin Heater: is a device that warms resin in the spray-gun line in order to make it more fluid.

Mill Gauge: is used to measure the thickness of gel coats.

Non-Atomized Application: is a method of applying resin to a fiber reinforcement using a fluid delivery device without atomizing the resin. This includes flow coaters, flow choppers, and pressure fed rollers.

NSEL: Nova Scotia Department of Environment and Labour.

Open-Mould Systems: are those that saturate reinforcement fibres (e.g. glass fibres) with resin and then use a manual roll-out technique to consolidate the laminate and remove the trapped air. The resin then cures in the open air.

Overspray Flanges: are used on a spray-mould to capture overspray and minimize the amount of wet resin that is deposited off the edge of the mould. Overspray flanges can be built into the mould as a permanent extension of existing flanges or as a part of the mould that has been designed specifically for controlled spraying.

Release Agents: are layers of material applied to the mould's surface to prevent the product from sticking. The release agent can be a wax, a fluid chemical like wax, or a solid sheet like mylar.

Resin: is the liquid component that is mixed with the glass fibers to make a fibreglass or composite product. Typical resin classes used by fibreglass manufacturers include polyesters, epoxies, vinyl esters and DCPD (dicyclopentadiene).

Smog: is a hazy chemical fog made up mainly of ground-level ozone formed by a reaction between volatile organic compounds and nitrogen oxides in the atmosphere. Adverse health impacts due to smog include itchy and watery eyes and respiratory problems.

Solvents: are chemical liquids commonly used by the fibreglass industry to clean equipment and tools. Acetone is the most commonly used solvent, and others include methyl ethyl ketone and methanol.

Spray-Up: is the practice of applying the fibreglass (or gun roving) mechanically with a chopper on a spray applicator.

Styrene: is a volatile organic compound emitted by most curing resins. It is also considered a reactive dilutent, which means that some of the styrene becomes a part of the finished product through the chemical process of curing. Epoxy resins are one type of resin that does not contain styrene.

Threshold Limit Value: is the maximum concentration of a chemical recommended for repeated exposure without adverse health affects on workers.

Transfer Efficiency: is a ratio of the amount of material sprayed compared to the amount that ends up on the mould surface.

Time Weighted Average Concentration: is the average concentration of an airborne substance that an individual can be exposed to over an eight-hour day.

TLV: See Threshold Limit Value

TWA: See Time Weighted Average Concentration

Vacuum Resin Transfer: involves covering the resin and fibreglass with a plastic vacuum bag and using a vacuum to saturate the fibreglass with the resin.

Volatile Organic Compounds: also known as VOCs, are types of gases that are emitted into the air by resins and solvents. Acetone vapour and styrene are two of the most common VOCs found in fibreglass shops. Exposure to VOCs can irritate the eyes, nose and throat, and cause nausea, dizziness and skin problems. Exposure to higher concentrations can cause anxiety and memory problems.

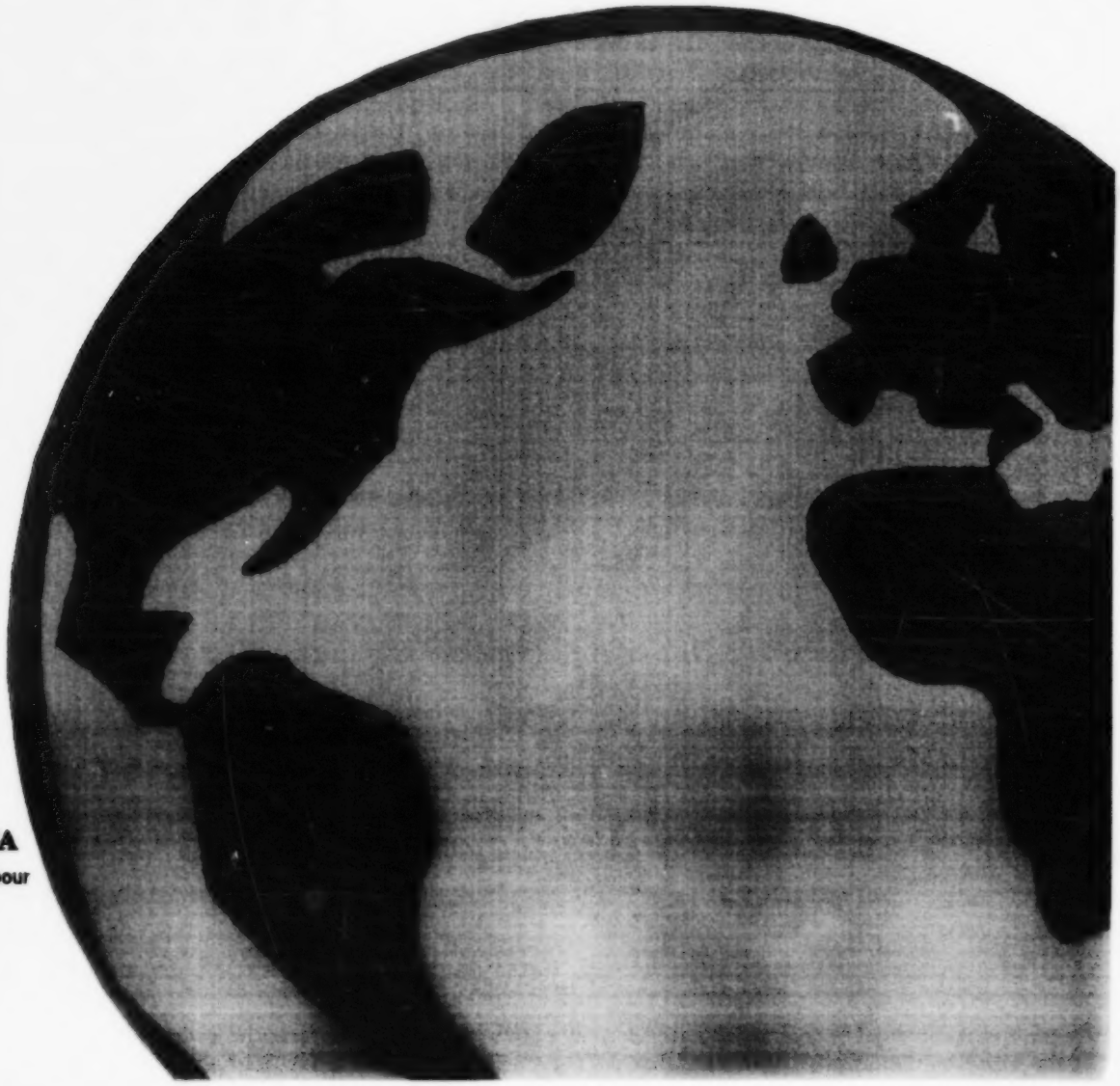
(VOCs): see Volatile Organic Compounds

Waste Dangerous Goods: are dangerous goods that are no longer in use for their original purpose or are materials that have become waste dangerous goods through their handling. This includes dangerous goods intended for treatment, disposal or recycling, but it does not include dangerous goods that have been returned directly to the manufacturer or the supplier of the dangerous goods for reprocessing, repacking or resale. This also does not include consumer paint products as defined in the Solid Waste-Resource Management Regulations.

Reducin' Pollution

An Environmental Health and Safety Guide for the Fibreglass Industry

Volume 2: Workbook



NOVA SCOTIA
Environment and Labour

i. Purpose of the Guide

The purpose of this guide set is to provide an up-to-date reference of some of the 'Best Practices ' used in the fibreglass industry today. The focus of this guide is health and the environment, but most initiatives listed will positively impact quality and productivity as well.

ii. The *Reducin' Pollution* Workbook

This workbook has been produced as a companion piece to the *Reducin' Pollution* guidebook. This workbook is a tool that can help fibreglass companies quickly identify how they can improve their environmental performance and develop an action plan.

iii. Acknowledgments

The Canadian Plastics Industry Association and the Nova Scotia Department of Environment and Labour would like to acknowledge the Nova Scotia Composites Environmental Health and Safety Working Group for their assistance in preparing this guide. In particular, they would like to thank Sandy Marshall, Sean O'Brien and Tony Sampson for their time and effort.

iv. Disclaimer:

The authors and sponsors of this guide intend for it to help improve the health and sustainability of the fibreglass industry. Every effort has been made to ensure the information is accurate and up to date. The authors and sponsors do not accept responsibility for accidents, incidents or other problems resulting from anyone following the practices recommended in this guide.

This guide provides information on the benefits of pollution prevention for the fibreglass industry in Nova Scotia. It also provides information on some of the relevant laws in effect in Nova Scotia. It does not provide information on how to comply with all provisions of those laws that may apply to businesses. This guide is not intended to replace reading the legislation and regulations or seeking advice from a lawyer or an environmental expert. Examples and interpretations given are not binding on the Crown. Amendments may be made to the legislation or regulations after the publication of this document and reference should be made to the most recent official version of the legislation and regulations.

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1 *The Pressures for Change on the Fibreglass Shop*

- Today's fibreglass and Fibre Reinforced Plastics (FRP) shops face many challenges that will require change:
  - ⇒ *Profitability*
  - ⇒ *Technical advances*
  - ⇒ *Occupational health and safety*
  - ⇒ *Environmental performance*
  - ⇒ *Complying with Regulations*
- The FRP Industry is a source of hazardous volatile emissions to the environment. **Styrene** and **acetone** are the largest contributors.

Key Issues

- Volatile Organic Compounds (VOCs)
  - ⇒ VOCs are chemical vapours emitted by fresh resin surfaces and by solvents such as acetone.
  - ⇒ Styrene is a key VOC found in fibreglass shops.
  - ⇒ In general, about half of styrene emissions occur during lay-up or spray-up with the other half given off by curing resin.
  - ⇒ Exposure to VOCs can cause irritation of the eyes, nose and throat, skin problems, nausea and dizziness.
  - ⇒ VOCs help to create smog.
- Odour Emissions
  - ⇒ Odour emissions can disturb people living or working near FRP shops.
- Drum Disposal and Recycling
  - ⇒ Left-over liquids in empty drums can be toxic or hazardous and must be disposed properly.
  - ⇒ Improperly disposed drums can cause health impacts and contaminate soil and groundwater.
  - ⇒ Empty drums should be returned for proper disposal or for recycling.

- Water Quality Management
  - ⇒ Water pollution can occur when contaminants are washed away by stormwater or rain or when discarded down the drain.
- Waste Management
  - ⇒ The disposal of solid waste is regulated in Nova Scotia.
  - ⇒ The most cost-effective way to manage your waste is to not generate it in the first place.
  - ⇒ Waste can be sorted for reuse, recycling and safe disposal.
- Hazardous Materials
  - ⇒ The storing, labeling and handling of hazardous materials (also referred to as dangerous goods) is regulated by the province through the Dangerous Goods Management Regulations and the Occupational Health and Safety Regulations.
  - ⇒ Hazardous materials are extremely dangerous in uncontrolled situations and cause serious injury or adverse environmental affects.
- Dust Management
  - ⇒ Fibreglass dust in the air can be a nuisance and is a physical hazard.
  - ⇒ Fibreglass dust is combustible and can be a fire hazard in the workplace.
- Noise Management
  - ⇒ Noise pollution can disturb people living or working near FRP shops.

2 *Pollution Prevention and You*

- The simple idea behind pollution prevention (P2) - prevent pollution by not creating it in the first place
- Reasons for P2 are all around us:
  - ⇒ Children, family, and friends
  - ⇒ Prot[illegible]ng the air, drinking water, and soil
  - ⇒ Protecting watercourses such as streams, lakes and rivers
  - ⇒ Protecting land areas such as forests, fields, and residential areas
- Involves rethinking how we do things
  - ⇒ Simple changes in behaviour and workplace practices can prevent pollution and not be costly
- Pollution prevention can save money
- Benefits of P2 to the workplace include:
  - ⇒ The reduced costs of using fewer raw materials
  - ⇒ Improvements to worker health and safety and environmental performance
  - ⇒ Lower costs on ventilation and safety equipment
  - ⇒ Easier compliance with regulations and reduced paperwork burden
  - ⇒ Reduced waste transportation and disposal costs
  - ⇒ Reduced long-term liability and insurance costs
- P2 focuses on areas such as:
  - ⇒ The use of hazardous and dangerous materials
  - ⇒ Using natural resources efficiently
  - ⇒ Conserving natural resources
  - ⇒ Improving production processes to create less waste
  - ⇒ Training
  - ⇒ Modifying or improving equipment
  - ⇒ Using more environmentally-friendly materials
  - ⇒ The design or formulas of products
  - ⇒ Product life-cycles
  - ⇒ Purchasing practices

3 *Pollution Prevention Best Practices for the Fibreglass Shop*

This section outlines some of the best practices in use for Pollution Prevention. Regulatory issues are also noted to point out compliance issues. New ideas and regulations are being generated on a continuous basis so this list should not be considered complete. These are just some of the options that are available. Businesses are encouraged to demonstrate their leadership and innovation by incorporating other pollution prevention methods into their own business operation

To help you identify the practices that most interest you, practices of note are indicated with any number of three icons.

This icon tells you when a best practice can save you money.

This icon indicates that a practice can help you lower your shop's levels of volatile vapours such as styrene or VOCs.

Practices that deal with regulations and the law are indicated with this icon.

All of the practices listed in this workbook are described in greater detail in the *Reducin' Pollution* Guidebook.

How to Use This Workbook

In this workbook, the pollution prevention best practices are organized into tables. Checkboxes labeled "Yes" and "No" are found on the right side of the tables. If the practice listed is one used in your fibreglass shop, place a checkmark next to it in the "Yes" box. If the practice is not used in your shop, then place a checkmark in the "No" box. There may be some cases where a particular practice does not apply to your shop. In these cases, simply write "DNA" for "does not apply" in either the "Yes" checkbox.

After each section, review your checklist to see what pollution prevention best practices you can add to your operation. For each practice that received a "no" checkmark, write these practices in the space below as your "Action Items" and check them off once they are completed.

3.1 Designing your Product

Designing your products with efficiency in mind can save money and minimize pollution *before* you start building! (See **page 6** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Optimize the design of your product		
Use core materials to strengthen your design while using less glass and resin.		
Use engineered reinforcements to increase the strength of your product		
Use non-hazardous fillers when building large pieces		
Substitute hazardous products with less hazardous ones where possible		
Specify low styrene resins and gelcoats		
Incorporate flanges into your mould design		
Educate your customers on "Environmentally Friendly" alternatives		
Consider the end-of-life recyclability of your finished product when designing it		

My Action Items

Action Item	Completed?

3.2 *Purchasing your Raw Materials*

The type and amount of product or raw materials purchased directly impacts on the degree of environmental risk and the ease of complying with regulations. Use your purchasing practices to reduce pollution, minimize your waste, and save your company money. (See **page 7** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Purchase smaller quantities to limit storage and age expiry issues		
Assess the true cost of your raw materials		
Track production to allow for smaller inventories		
Purchase products in recyclable containers that use a minimum amount of packaging		
Encourage suppliers to demonstrate new products and ideas		
Use local materials and recycled materials where possible		

My Action Items

Action Item	Completed?

3.3 *Storing your Materials*

Properly storing dangerous goods such as resin, catalysts, solvents, release agents and other products is crucial for all fibreglass shops. Improperly stored dangerous materials are a threat to worker health, the environment and are also against the law! (See **page 8** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Keep minimum quantities		
Track your inventory closely		
Train your workers on WHMIS, regulations, and emergency procedures		
Report the spill, leak or release of any dangerous or hazardous materials		
Store all flammable and reactive materials safely and according to regulations		
Keep a safe and clean storage area		

My Action Items

Action Item	Completed?

3.4 Pouring and Mixing your Materials

Bad pouring and mixing practices do more than emit styrene and release VOCs to the air. They can also cause adverse environmental impacts, contaminate property, and pollute watercourses and groundwater. Sloppy pouring and mixing also wastes product and can create dangerous, explosive situations. (See **page 9** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Order your products pre-mixed, and always agitate the drums before using		
Improve your tracking system to account for substance use and waste generation		
Modify your production schedule to improve the efficiency of your process		
Label your products and wastes as specified by the WHMIS regulations		
Follow the proper procedures for mixing and transferring product and cleaning tools		
Use a proper electrical system, inspect it regularly and eliminate sources of static charges		
Practice good housekeeping		

My Action Items

Action Item	Completed?

3.5 *Producing your Fibreglass Product*

A major source of the hazardous volatile emissions emitted by fibreglass shops occurs during production and the product lay-up or spray-up. There are several ways in which a fibreglass shop can modify its practices to reduce these emissions. This section examines how to improve production methods, systems and equipment. (See **pages 10 and 11** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Production Methods		
Where appropriate, invest in a closed-mould system instead of open-mould (e.g. infusion, vacuum or resin transfer processes)		
Use styrene suppressants in the resin to limit emissions		
Apply a thicker lay-up or spray-up at one time		
Manage your cure system through good catalyst practices, and trial alternative cures		
Production Systems		
Improve the production schedule to maximize process efficiency		
Use the best equipment and materials suited for the job and use only what you need		
Track the use of materials, waste generation and costs		
Improve housekeeping and maintenance		
Improve worker training and awareness		

My Action Items

Action Item	Completed?

Practice	Yes	No
Production Equipment		
Use non-atomized resin applicators such as fluid impingement, flow coaters or pressure-fed roller impregnators to apply resins and gelcoats		
Use a mill gauge when applying gelcoats to measure the thickness of the application		
Install overspray flanges on all moulds to reduce the area of overspray		
Use in-line resin heaters instead of extra styrene to improve the flow of resin		

My Action Items

Action Item	Completed?

3.6 *Training and Awareness in the Workplace*

When encouraging workplace employees to adopt new and safer practices, training and awareness is key. There are many new and safer production techniques that workers can use if they are shown how. (See **page 12** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Show spray operators how to use controlled-spraying techniques		
Train operators to apply only specified amounts		
Make it a routine practice to follow the proper procedures for mixing, transferring and applying gel coats and laminates and for cleaning and maintaining equipment and moulds		
Provide employee training on regulations, emergency procedures, and on health and safety issues		
Train staff on proper housekeeping practices		
Train employees on how to use emergency equipment - and keep the equipment in a convenient, visible location		
Wear gloves and avoid using acetone to wash hands		

My Action Items

Action Item	Completed?

3.7 Cleaning your Equipment and Tools

Not only will these steps improve the quality of the air in your shop, it will also reduce your risk of harming the environment and improve the environmental performance of your company. (See **page 13** of the Best Practices guide for more information on these practices)

Best Practices

Practice	Yes	No
Switch to a non-VOC type cleaning solution		
Use cleaning solvents for a longer period of time		
Use the "two buckets" washing system - one is clean, and the other is dirty		
Keep lids on all buckets		
Install a gun cleaning tank or unit		
Ration solvents and other material		
Limit the number of cleaning buckets in the workplace		
Physically remove excess resin from tools before using a solvent wash		
Collect all used solvent and recycle it "in-house" or by using contractors		

My Action Items

Action Item	Completed?

3.8 *Managing your Waste*

Responsible waste management is not just a sound environmental and economic practice, but it is also legislated in Nova Scotia. Reducing your waste and managing it properly can result in lower tipping fees, reduced transportation costs, and cost savings through the reuse and recycling of materials. (See **page 14** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Keep your workplace tidy and well-maintained		
Identify wastes with clear and easy-to-read labels		
Keep lids on all wastes		
Use all of the product from the drums		
Store empty drums properly		
Minimize the amount of grinding, cutting and sanding that you have to do		
Collect dust at the source using well-placed vents and vacuums		
Develop a waste management system to that allows your workplace to separate, reuse and recycle its waste		
Dispose of hazardous waste and solid waste properly		
Do not open-burn wastes (e.g. barrel burning)		

My Action Items

Action Item	Completed?

3.9 *Designing your Facility*

Pollution prevention should be incorporated into the design of any production facility. A wide range of considerations should be included, such as energy efficiency, waste management, noise pollution, and others. (See **page 15** of the guidebook for more information on these practices)

Best Practices

Practice	Yes	No
Design and maintain your facility to be energy efficient in order to reduce heating and electrical costs		
Limit the size of your lay-up area to reduce ventilation and heating requirements		
Use proper temperature controls in the production areas to improve process efficiency		
Plan your ventilation system to reduce the overall air-flow while controlling dust and chemical hazards		
Design for emergencies, fire protection and spill containment		

My Action Items

Action Item	Completed?

4 Resources

4.1 Government Departments

Nova Scotia Environment and Labour

Phone: (902) 424-5300
Toll Free: 1-877-9ENVIRO
Fax: (902) 424-0503

Website: http://www.gov.ns.ca/enla/
Pollution Prevention website: go to the NSEL website, click on "Information and Services", and find Pollution Prevention under "P" in the index.

Office of the Fire Marshall

Phone: (902) 424-5721
Toll Free: 1-800-559-3473 (FIRE)
Fax: (902) 424-3239

Website:
http://www.gov.ns.ca/enla/ofm/index.htm

For more information on the government regulations described in this guide, please visit the following websites:

Regulations under the Occupational Health and Safety Act (including the general regulations, first aid regulations and the WHMIS regulations)
http://www.gov.ns.ca/enla/ohs/publicat.asp

Dangerous Goods Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envdgm.htm

Petroleum Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envpetma.htm

Used Oil Regulations
http://www.gov.ns.ca/just/regulations/regs/env17996.htm

Air Quality Regulations
http://www.gov.ns.ca/just/regulations/regs/envairqt.htm

Solid Waste-Resource Management Regulations
http://www.gov.ns.ca/just/regulations/regs/envsolid.htm
http://www.gov.ns.ca/enla/emc/wasteman/ (Solid Waste Resource Management branch homepage)

Emergency Spill Regulations
http://www.gov.ns.ca/just/regulations/regs/env5995.htm

5 *Glossary*

Acetone: is a solvent commonly used in fibreglass shops for cleaning tools and equipment.

Barrel Burning: is the act of burning waste in a barrel or drum. It generates significant amounts of pollution and is prohibited in Nova Scotia.

Catalysts: are added to epoxy and polyester resins to make them harden. Also referred to as hardeners.

Closed-Mould Systems: are those that completely encase the resin within a mould. The resin then cures while sealed from the open air.

Compaction Roller: is a serrated or bristle roller that comes in various shapes. It is used on most laminates to provide compression and movement of the reinforcement in order to ensure wetout and to remove trapped air.

Controlled-Spraying: is a method of applying fibreglass resin using a spray gun and closed containment mould flanges. It reduces styrene emissions by minimizing the amount of spray gun atomization and by reducing the amount of overspray lost off the mould edge.

Core Materials: are used to stiffen fibreglass laminates. Examples of core materials used are balsa wood, foam, or honeycomb.

Curing: is the chemical reaction that takes place while the catalyzed resin changes from a liquid to a solid. Heat is generated during this process and as much as 50% of the styrene emissions occur.

Dangerous Good: is defined in the Dangerous Goods Management Regulations as a substance that conforms to the criteria set out in the federal Transportation of Dangerous Goods Regulations or is designated as a dangerous good in Schedule B of the federal Transportation of Dangerous Goods Regulations. This generally includes (but is not limited to) products, substances or organisms are included in at least one of the nine following classes: explosives, gases, flammable liquids, flammable solids, oxidizing substances, poisonous or infectious, radioactive, corrosive, or miscellaneous.

End-of-Life: refers to the period when a product is no longer usable or wanted.

Engineered Reinforcements: are synthetic - or man-made - materials that can be used to add rigidity or strength to fibreglass forms. Examples include knitted fabrics, three-dimensional fabrics, carbon fibre, aramid fibres such as Kevlar, and high tension steel wire.

Flow Coater: is a mechanical resin applicator that uses a catalyzing resin pump with a number of low pressure streams to deliver catalyzed resin directly to a laminate. A flow coater can also be outfitted to deliver chopped glass fibres.

Fluid Impingement System: is a delivery system that creates a flat, fan shaped sheet of catalyzed resin by shooting two high pressure streams of resin at each other at a precise angle. The catalyst can be mixed with the resin within the gun (an internal mix) or as it exits the spray tip (an external mix). The system can be used to deliver chopped glass fibres as well.

Groundwater: is the water system that flows under the ground. Groundwater often flows into (and in some cases replenishes) drinking wells, water receivers, lakes, and streams.

Hand Lay-Up: is the process of manually placing the fibreglass reinforcements (such as mats, woven roving, knits, etc.) into the mould or onto part, where resin is then applied mechanically or manually.

Infusion Resin Transfer: is the process of filling an enclosed reinforcement layer with resin. This is usually done by a vacuum drawing the resin into the emptied air spaces. It can also be assisted by applying pressure to the resin to help push it through the fibres.

In-Line Resin Heater: is a device that warms resin in the spray-gun line in order to make it more fluid.

Mill Gauge: is used to measure the thickness of gel coats.

Non-Atomized Application: is a method of applying resin to a fiber reinforcement using a fluid delivery device without atomizing the resin. This includes flow coaters, flow choppers, and pressure fed rollers.

NSEL: Nova Scotia Department of Environment and Labour.

Open-Mould Systems: are those that saturate reinforcement fibres (e.g. glass fibres) with resin and then use a manual roll-out technique to consolidate the laminate and remove the trapped air. The resin then cures in the open air.

Overspray Flanges: are used on a spray-mould to capture overspray and minimize the amount of wet resin that is deposited off the edge of the mould. Overspray flanges can be built into the mould as a permanent extension of existing flanges or as a part of the mould that has been designed specifically for controlled spraying.

Release Agents: are layers of material applied to the mould's surface to prevent the product from sticking. The release agent can be a wax, a fluid chemical like wax, or a solid sheet like mylar.

Resin: is the liquid component that is mixed with the glass fibers to make a fibreglass or composite product. Typical resin classes used by fibreglass manufacturers include polyesters, epoxies, vinyl esters and DCPDS.

Smog: is a hazy chemical fog made up mainly of ground-level ozone formed by a reaction between volatile organic compounds and nitrogen oxides in the atmosphere. Adverse health impacts due to smog include itchy and watery eyes and respiratory problems.

Solvents: are chemical liquids commonly used by the fibreglass industry to clean equipment and tools. Acetone is the most commonly used solvent, and others include methyl ethyl ketone and methanol.

Spray-Up: is the practice of applying the fibreglass (or gun roving) mechanically with a chopper on a spray applicator.

Styrene: is a volatile organic compound emitted by most curing resins. It is also considered a reactive dilutent, which means that some of the styrene becomes a part of the finished product through the chemical process of curing. Epoxy resins are one type of resin that does not contain styrene.

Threshold Limit Value: is the maximum concentration of a chemical recommended for repeated exposure without adverse health affects on workers.

Transfer Efficiency: is a ratio of the amount of material sprayed compared to the amount that ends up on the mould surface.

Time Weighted Average Concentration: is the average concentration of an airborne substance that an individual can be exposed to over an eight-hour day.

TLV: See Threshold Limit Value

TWA: See Time Weighted Average Concentration

Vacuum Resin Transfer: involves covering the resin and fibreglass with a plastic vacuum bag and using a vacuum to saturate the fibreglass with the resin.

Volatile Organic Compounds: also known as VOCs, are types of gases that are emitted into the air by resins and solvents. Acetone vapour and styrene are two of the most common VOCs found in fibreglass shops. Exposure to VOCs can irritate the eyes, nose and throat, and cause nausea, dizziness and skin problems. Exposure to higher concentrations can cause anxiety and memory problems.

(VOCs): see Volatile Organic Compounds

Waste Dangerous Goods: are dangerous goods that are no longer in use for their original purpose or are materials that have become waste dangerous goods through their handling. This includes dangerous goods intended for treatment, disposal or recycling, but it does not include dangerous goods that have been returned directly to the manufacturer or the supplier of the dangerous goods for reprocessing, repacking or resale. This also does not include consumer paint products as defined in the Solid Waste-Resource Management Regulations.